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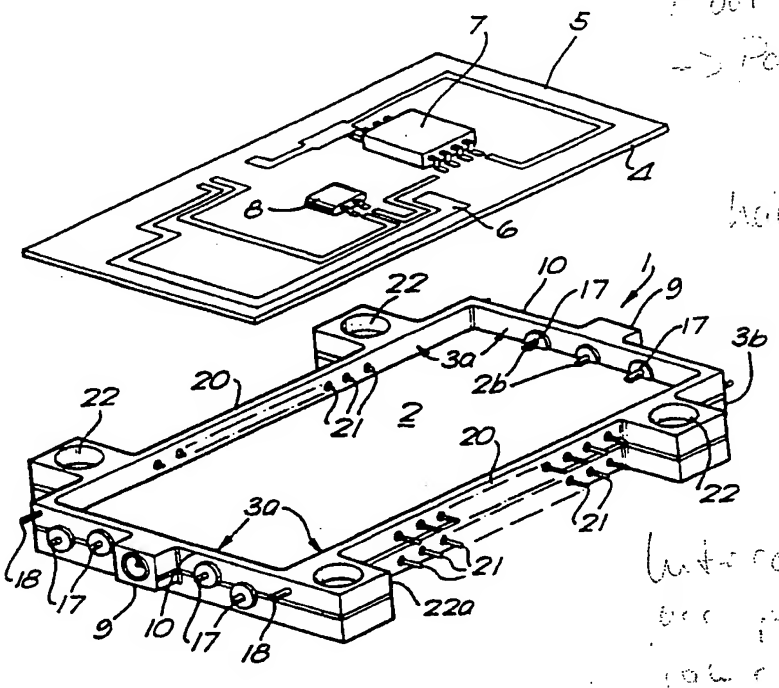
(54) Title: PACKAGING FOR HYBRID CIRCUITS




(57) Abstract

A frame for hybrid circuit comprises a floor surrounded on each face by a respective upstanding rim and in which the floor provides a ground plane for circuits mountable upon each face of the floor. The rims include sockets to receive R.F. connectors for supplying R.F. signals into and out of the circuits, the rims further including connection means by which digital and/or D.C. signals can be interconnected with the circuits.

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# Packaging For Hybrid Circuits

The present invention relates to packaging and especially to a frame for hybrid circuits of the type in which R.F. signals are processed using digital and/or D.C. techniques.

Such hybrid circuits are usually formed on an alumina substrate and may include thick film circuits formed thereon together with hermetically sealed flat packs and conventional surface mounted components. Conventionally, the aluminate substrates are of a standard size of 2 inches by 1 inch (5.08 cm by 2.54 cm) and are mounted within rebates within a metal chassis to provide a heat sink and electromagnetically shield the circuitry. It can be awkward to provide the necessary R.F. and digital interconnections between external components and the components on the substrate and to pack the circuits to a high density. It is accordingly an object of the invention to provide packaging for hybrid circuits which allows the circuits to be packed to a high density, and allows R.F. signals and digital and/or D.C. signals to be connected into and out of the circuits in a straight forward way.

According to the invention a frame for hybrid circuits comprises a floor surrounded on each face by a respective upstanding rim, in which the floor provides a ground plane for circuits mountable upon each face of the floor, the rims including sockets to receive complementary R.F. connectors for supplying R.F. signals into and out of the circuits, the rims further including connection means by which digital and/or D.C. signals can be interconnected with the circuits.

Because a single floor can be used to provide a ground plane for two circuits, the two circuits do not need to be housed separately, which means that there can be an overall reduction in height when several such frames are stacked one above the other. The use of such frames also allows the circuits to be mounted in a modular way which can facilitate the design and manufacture of systems or devices comprising such circuits. The presence of sockets on the rim to receive complementary R.F. connectors ensures that R.F. signals can be interconnected with the circuits in a simple and convenient way, and can omit the need for R.F. leads to extend into the circuits from above. The digital and/or D.C. connection means in the rims of the frame ensures that such signals can be applied to suitable components which are mounted on circuits within the same frame as R.F.

components.

The frame may be formed in two halves sandwiched together about a floor, or may be formed in one piece with an integral floor. In an alternative construction the frame comprises a plurality of wall members having inter-engaging means for connecting the wall member to the floor and/or to an adjacent wall member. Preferably the frame is of rectangular shape in plan and includes R.F. sockets on opposing faces of the rim. The sockets are preferably offset with respect to the central floor so that a pin housed centrally within the socket for interconnection with a suitable connector extends inwardly into the frame above one or other face of the floor. The pin within the R.F. socket may be retained within an annular block of insulating material secured within the socket. The floor preferably includes a recess extending inwardly of the floor from the edge portion located adjacent the socket and a further recess in the surface of the floor to be located beneath the portion of the pin that extends into the interior of the frame. The rim may also include further R.F. pins for making R.F. connections, e.g. between adjacent frames.

In order that the invention may be well understood, embodiments thereof will now be described with reference to

the accompanying drawings, in which:

Figure 1 is an exploded isometric view of a frame and a hybrid circuit according to the invention;

Figure 2 is a plan view of the frame shown in Figure 1;

Figures 3 and 4 are respectively sectional views along lines X-X and Y-Y of Figure 2;

Figure 5 is a view to an enlarged scale of part of Figure 3 showing the detail of the R.F. socket;

Figure 6 is a plan view showing how frames of the type shown in Figure 1 can be stacked together within a chassis;

Figure 7 is a schematic longitudinal sectional view of the stack of frames shown in Figure 6;

Figure 8 is an isometric view of a frame according to another embodiment of the invention; and

Figure 9 is an exploded isometric view of a frame according to yet another embodiment of the invention.

As shown in Figure 1, a frame 1 is of generally rectangular shape and comprises a central floor 2 from each face of which extends a respective upstanding rim 3a, 3b. The accessible floor area is sufficient to contain two hybrid circuits 4 of standard 2 inch by 1 inch (5.08 cm by 2.54 cm) size, one bonded to each face of the floor (only one such circuit is shown in Figure 1). The circuits each comprise an aluminate substrate 5 upon which tracks 6 are formed together with, for instance, thick film circuits and also conventional hermetically sealed flat packs 7 and surface mounted components 8.

The frame shown in Figure 1 comprises two rim halves 3a, 3b, sandwiched about the floor 2. Both faces of the floor are earthed which can therefore act as a ground plane for the hybrid circuits 4. The rim halves 3a, 3b may be formed from an alloy such as Kovar with a copper tungsten floor 2. The whole frame may then be gold-plated.

An R.F. socket 9 defining a primary R.F. interface to receive a complementary connector is formed within each shorter end 10 of the frame for interconnecting R.F. signals into and out of the circuitry. The detail of the R.F. socket 9 is best shown in Figure 5 and comprises an

outward extension 11 including a through passageway 11a defining the socket. At the innermost end of the passageway 11a, a 50 ohm glass bead terminal comprises a pin 12 located within an annular bead 13 of glass, as an insulating material. The edge portion of the floor 2 to be located adjacent the bead 13 includes slot 2a into which the bead 13 extends. During manufacture of the frame the glass beads 13 can be located by this slot 2a to act as a self-jigging feature. The face of the floor underlying the portion 12a of the pin 12 which extends inwardly of the frame includes a recess 2b to minimise the chance of any contact between the earthed floor and the pin 12. It can also be seen that the glass bead terminal 12, 13 is not located centrally with respect to the floor so that R.F. signals may be applied directly only to hybrid circuits mounted on one or other face of the floor. The socket 9 has the internal features of a S.S.I.S. (sub-mounting slide in series) connector, but which is shorter in an axial direction than the known connectors so that when it is abutted with a chassis wall 15 of predetermined thickness, a standard S.S.I.S. connector (not shown) can be inserted through a hole 16 in the chassis to mate with the pin 12. Providing the main R.F. interface 9 as an integral socket allows the frame to be thinner than would be the case if a suitable connector was attached as a separate item and where there would have to be sufficient

height in the frame to retain such a separate connector. The sockets 9 can also be connected to one another using a so called jack-to-jack blind mate connector to be inserted in between and to bridge the two sockets 9.

As shown in Figures 1 to 4, secondary 50 ohm R.F. glass bead terminals 17 are located within the shorter end walls 10 of the frame. Two such terminals 17 are provided at each end of the frame for each hybrid circuit. The floor 2 preferably includes similar recesses 2a, 2b as for the primary R.F. interface 9. The pins of the glass bead terminals 17 provide a secondary R.F. interface for circuit components and allow R.F. connections to be made either to adjacent frames or to remote terminations by means of microwave laminate, P.C.B's, short wires, or semi-rigid cable. Earth pins 18 are also provided on each shorter end wall 10 of the frame and are used to retain the strip-line or P.C.B's, where appropriate, and in addition earth bond adjacent frames.

The longer side walls 20 of the frame carry conventional glassed-in pins 21, each side wall carrying two parallel arrays of pins, one array for each face of the floor 2. The pins 21 provide digital and D.C. interfaces for the circuit components and allow printed film wiring to

be used for interconnections.

The frame includes three mounting lugs 22 which are each spaced apart from the adjacent shorter end wall 10 by an amount equal to the width of the lug, and a fourth lug 22a extending flush with the respective adjacent end wall 10. In this way, by rotating one such frame through 180° with respect to the other, the lugs can interleave, as is best seen in Figure 6. The lugs 22, 22a extend outwardly from the frame for a distance sufficient to allow space to connect the pins 21. The lugs 22, 22a include holes 24 through which tie bars, not shown, can be inserted when the frames are stacked one above the other, as is shown in Figure 7, in which screening between hybrid circuits carried by the frames is provided by the floor of the frame and, if necessary, a metal foil 25 located between adjacent stacked frames. The floor of the chassis 15 within which the hybrid frames are mounted also provides screening. As discussed with reference to Figure 5, R.F. connectors (not shown) may extend through the chassis wall 15 and into the sockets 11. The frames can be as thin as 5.5 mm and this, together with the other features, allows a high packing density as is shown in Figure 7.

In the embodiment shown in Figure 8, a frame 30

includes a floor 2 which is formed integrally with the rims 3. Such a frame can be formed by removing, e.g. machining away, excess material from a suitable block thereof. The floor 2 includes, as shown, holes 31 through which hybrid circuits, such as the circuit 4 shown in Figure 1, can be interconnected. The frame 30 also includes five integrally formed main R.F. interfaces or sockets 9 in one of the shorter end faces 10.

Figure 9 shows yet another embodiment of the invention, in which each wall 41, 42, 43 and 44 of the rims of the frame 40 comprises a planar member formed from a lightweight material such as beryllium. A floor 2 comprising a sheet of beryllium includes castellations 45 along the edges to provide a means of inter-engaging the floor with complementary slots 46 formed in the walls 41-44 defining the two rims. Additionally, each end of the longer walls 42, 44 includes a tongue 47 to engage a complementary recess 48 in the corresponding the end of the shorter walls 41, 43. Mounting lugs 22 are connected to the longer side walls 42, 44 in similar fashion. The inter-engaging castellations 45 and tongues 47 may be secured in their respective slots 46, 48, by brazing. All the parts, being formed from a planar sheet of material, can be conveniently formed using a photographic mask technique to provide the

components pre-formed from, for instance 0.5 mm thick beryllium. Beryllium is not only light weight, but has a further advantage in that its thermal conductivity is sufficiently good that it will transfer heat even when it is relatively thin. The main R.F. interfaces 9 are provided by annular cylinders 49 secured within holes 50 in the shorter end walls 41, 43. The digital and/or D.C. pins, instead of comprising glassed-in terminals, comprise pins 53 located within thermo-plastic sleeves 54 which are heated so as to rivet the sleeve through the wall and secure the pins 53 in position.

The hybrid frames described may also be used for M.I.C. (microwave integrated circuit) purposes when the previously mentioned foil screen could be replaced by a cover bonded to the rim 3 of the frame. This cover may be raised in height to prevent microphony.

CLAIMS

1. A frame for hybrid circuits, the frame comprising a floor surrounded on each face by a respective upstanding rim, in which the floor provides a ground plane for circuits mountable upon each face of the floor, the rims including sockets to receive complementary R.F. connectors for supplying R.F. signals into and out of the circuits, the rims further including connection means by which digital and/or D.C. signals can be interconnected with the circuits.

2. A frame, according to claim 1, in which the frame is formed in two halves sandwiched together about a floor.

3. A frame, according to claim 1, in which the frame is formed in one piece with an integral floor.

4. A frame according to claim 1, in which the rim comprises a plurality of wall members each having inter-engaging means for connection to the floor and/or an adjacent wall member.

5. A frame, according to any preceding claim, in which the frame, or parts thereof, are made by removing excess material from a block thereof.

6. A frame, according to any preceding claim, which is of rectangular shape in plan and includes R.F. sockets on opposing end walls of the rims.

7. A frame, according to any preceding claim, in which the R.F. sockets are offset with respect to a centrally located floor.

8. A frame, according to any preceding claim, including outwardly extending lugs, one of which is offset to allow adjacent like frames to interleave with one another.

9. A frame, according to any preceding claim, in which the floor includes holes through which the circuits on each face of the floor can be inter-connected.

10. A frame for hybrid circuits substantially as described with reference to any one of the drawings.

FIG. 1

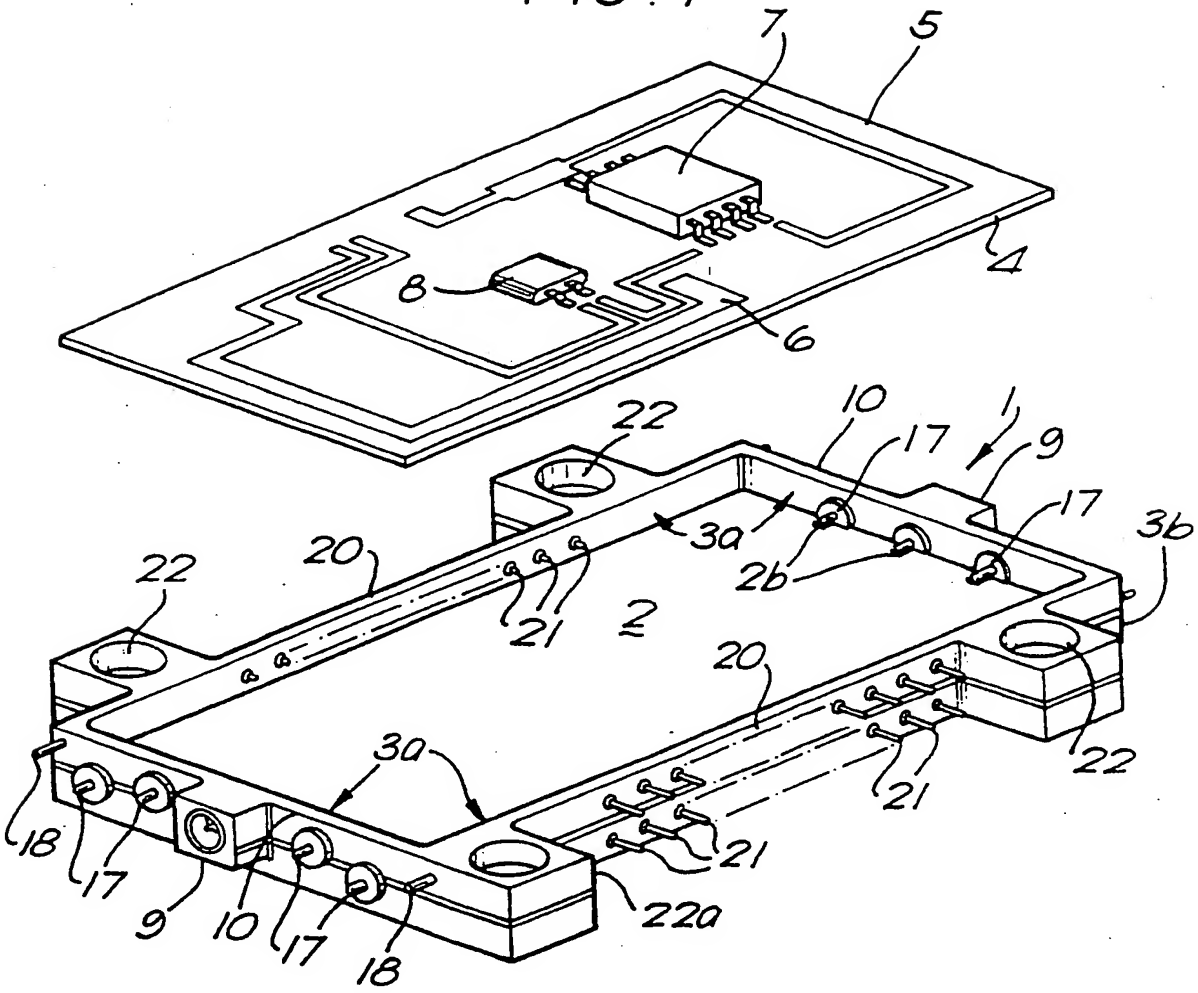


FIG. 2

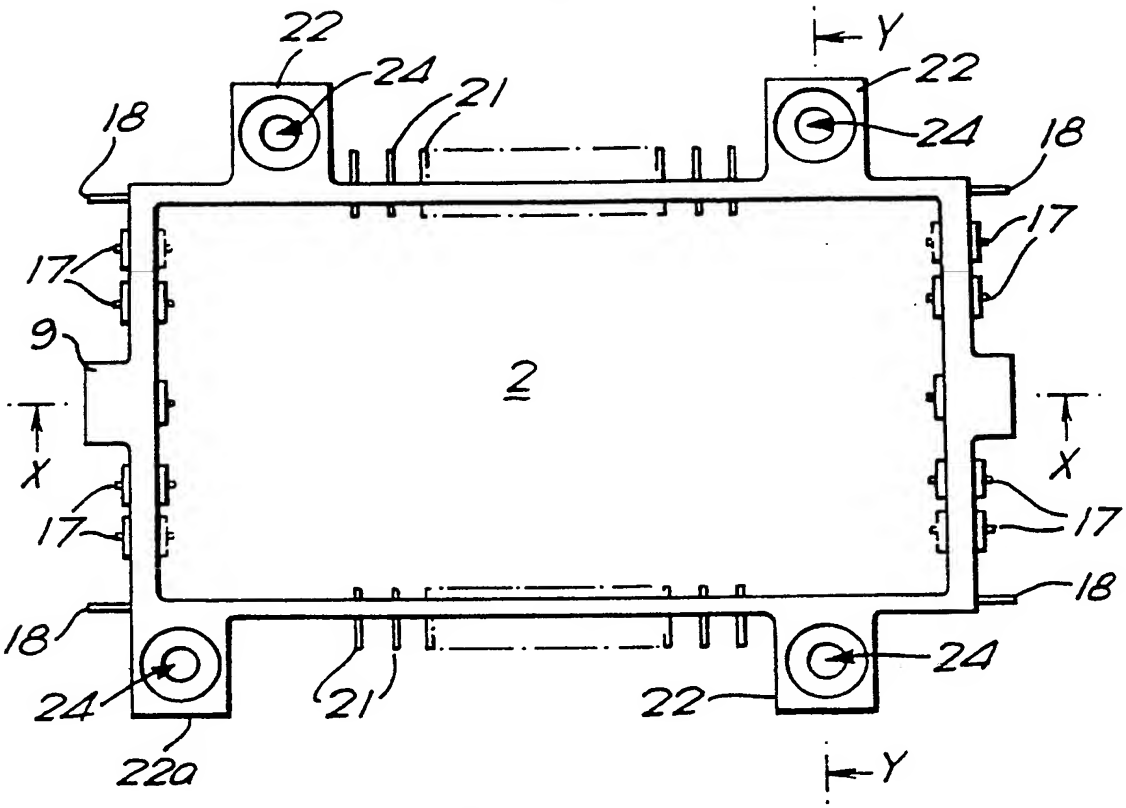



FIG. 3

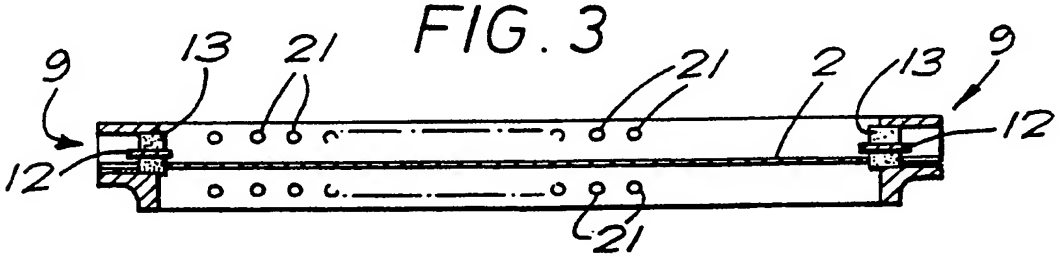



FIG. 4

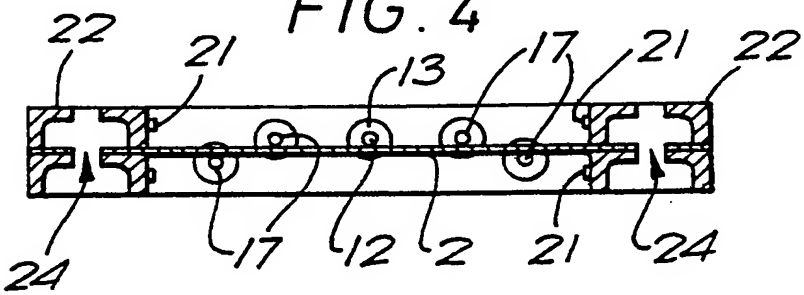


FIG. 5

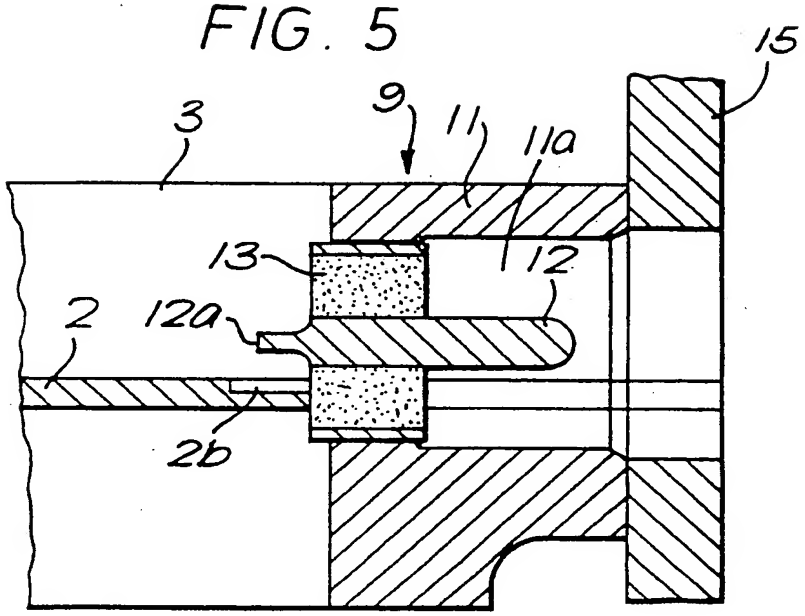



FIG. 7

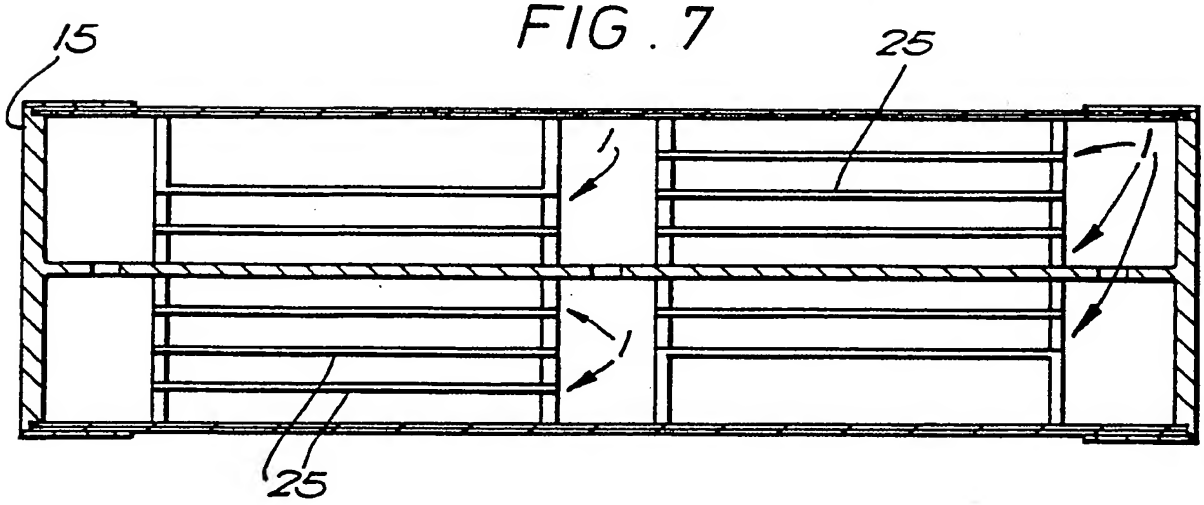


FIG. 6

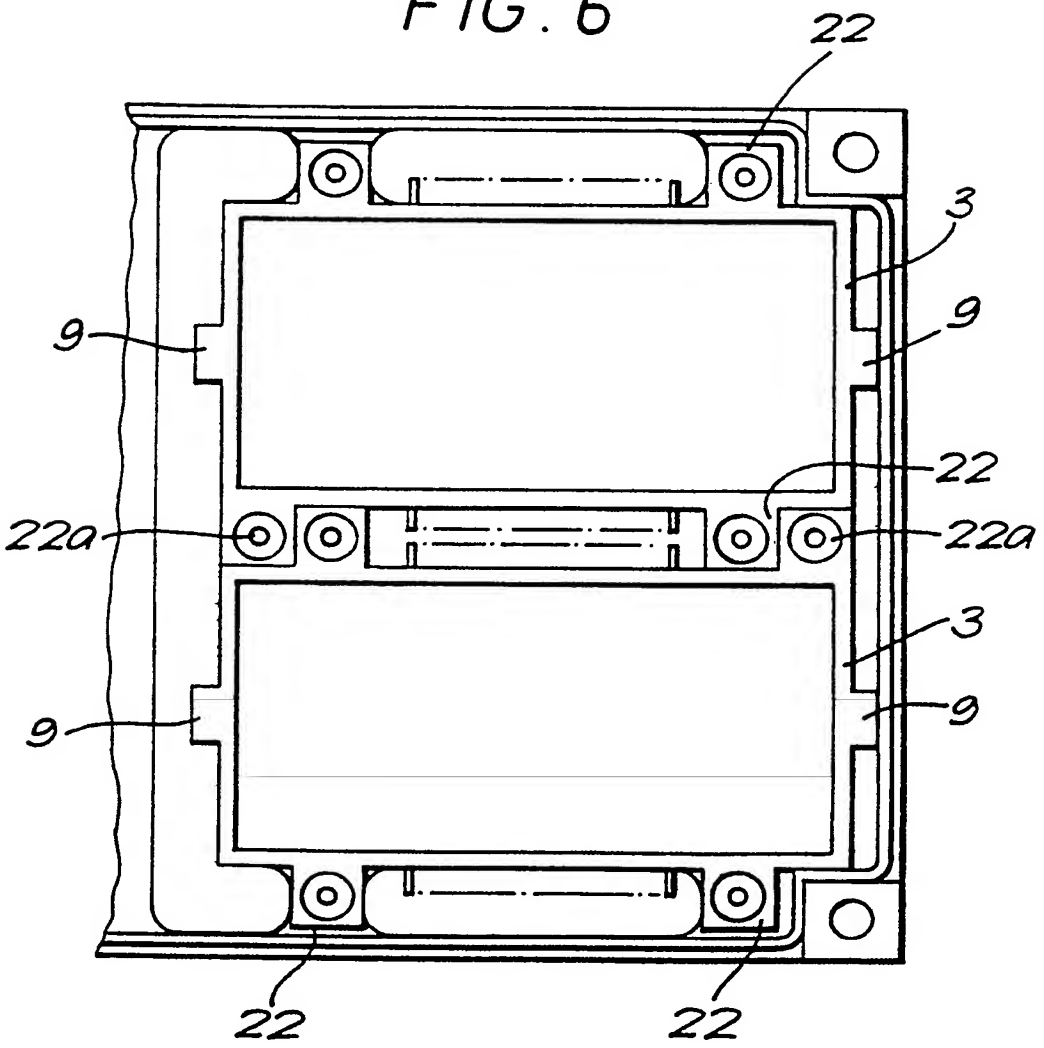


FIG. 8

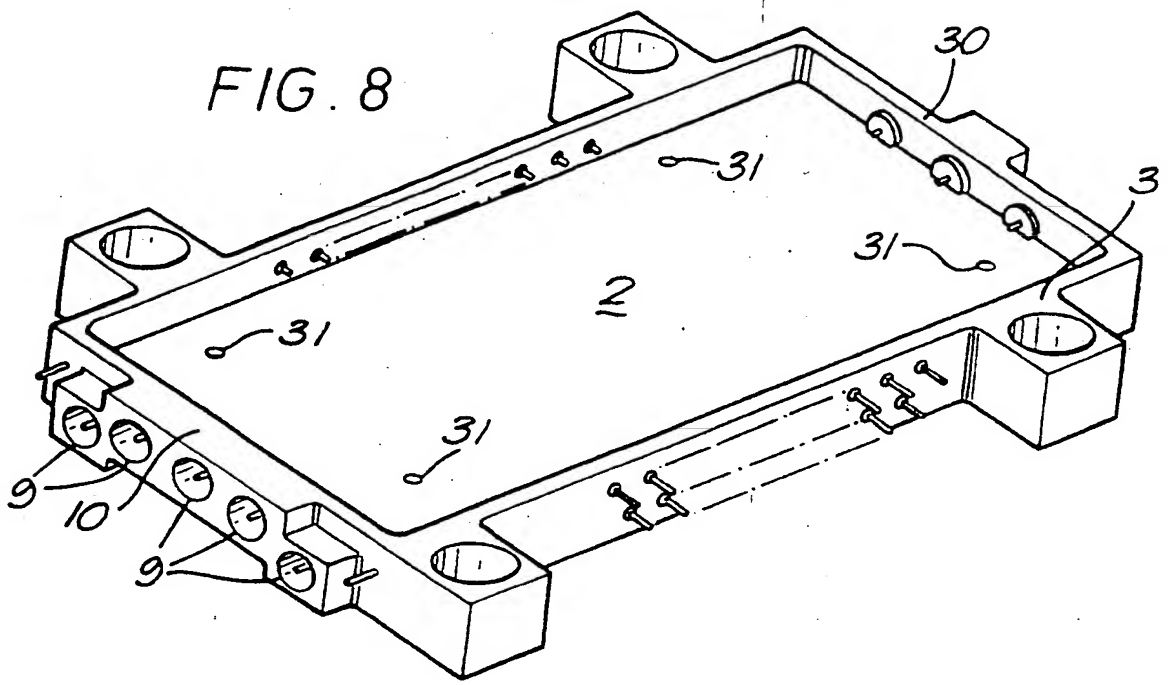
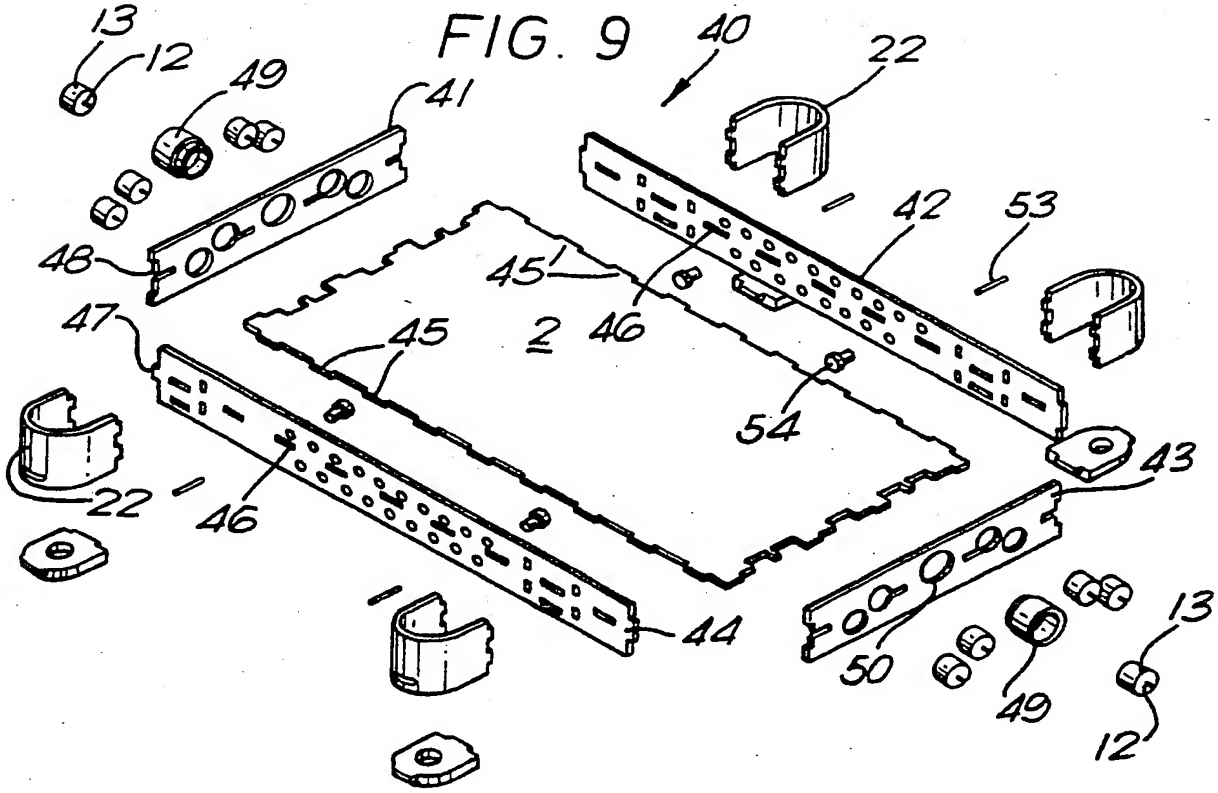



FIG. 9



# INTERNATIONAL SEARCH REPORT

International Application PCT/GB 91/01341

## I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl. 5 H05K5/00

## II. FIELDS SEARCHED

Minimum Documentation Searched[7]

| Classification System | Classification Symbols |
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| Int.Cl. 5 | H05K ; H01L |

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched[8]

## III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

| Category * | Citation of Document,[11] with indication, where appropriate, of the relevant passages[12] | Relevant to Claim No.[13] |
|---|---|---|
| A | EP,A,0 233 824 (ISOTRONICS) 26 August 1987 see the whole document | 1 |
| A | US,A,3 548 076 (R.B.W. COOKE) 15 December 1970 see the whole document | 1 |
| A | US,A,4 506 108 (KERSCH ET AL.) 19 March 1985 see the whole document | 1 |
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| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---|---|---|
| EP-A-0233824 | 26-08-87 | JP-A- 62209843 | 16-09-87 |
| US-A-3548076 | 15-12-70 | DE-A- 1956880<br>GB-A- 1207728 | 18-06-70<br>07-10-70 |
| US-A-4506108 | 19-03-85 | None | |
| FR-A-2352480 | 16-12-77 | None | |